SAMPLING AND ANALYSIS PLAN

GROUNDWATER COMPLIANCE MONITORING

The points of compliance for meeting groundwater cleanup levels at the Priceless Gas Site were selected on the basis of the criteria specified in WAC 173-340-720(8). The points of compliance are monitoring wells MW-1, MW-2, MW-3, and MW-6 (refer to Figure 1 for compliance well locations).

Groundwater cleanup levels have been established for the Site using MTCA Method A, as provided for in WAC 173-340-720(3). Although the groundwater in this area is an unlikely source of potable groundwater, Ecology has chosen to apply the more conservative cleanup values defined under Method A. The conservative approach was selected out of consideration of the potential threat to Cottonwood Creek and historical problems with increased exposure risk due to the high groundwater conditions.

CONSTITUENT	GROUNDWATER CLEANUP LEVEL	SAMPLE RESULTS FROM RI
BENZENE	5 µg/l	4.81 – 41,800 µg/l
TOLUENE	1,000 µg/l	0.624 – 3,730 µg/l
ETHYLBENZENE	700 µg/l	ND – 2,040 µg/l
XYLENES	1,000 µg/l	ND – 5,740 µg/l
MTBE	20 µg/l	154 – 2,750 µg/l
TPH (Gasoline)	800 µg/l	ND – 41,800 µg/l
TPH (Diesel)	500 µg/l	ND – 4,540 µg/l

ND = less than laboratory method detection limit
µ/l = ppb

Quarterly groundwater monitoring will include the sampling and analysis of previously identified points of compliance wells (MW-1, MW-2, MW-3, and MW-6) and system performance will be accomplished through the sampling of: MW-4, MW-5, MW-7, MW-8, MW-9, and MW-10 (refer to Figure 1 for system performance monitoring well locations). Groundwater monitoring will continue until compliance with the established cleanup levels is demonstrated for four (4) consecutive quarterly sampling events. Groundwater monitoring will be conducted in a manner consistent with the MTCA provisions for compliance monitoring described in WAC 173-340-720(9).

GROUNDWATER SAMPLE COLLECTION

Samples will be collected from the groundwater monitoring wells using disposable bailers or a peristaltic pump. Groundwater sampling for compliance monitoring will be conducted using the following protocol:

- Depth to water will be measured in each monitoring well prior to sampling.
- Order of sampling wells will be from least to most observed contamination.
- The well will be purged using a pump or disposable bailer and field parameters (temperature, pH, and specific conductance) will be measured after each well volume is purged.
- A minimum of three (3) well volumes will be purged.
- Samples will be collected in the order of decreasing volatility of the analytical parameters.
- Depth to water will be measured following purging and sample collection.

Laboratory Analyses

Samples will be submitted to North Creek Analytical (Spokane, Washington), or equivalent accredited laboratory for the following analyses (minimum required for compliance monitoring). Additional field and laboratory parameters will be included for treatment system evaluation, as required:

Parameters	Methods
Volatile petroleum hydrocarbons (gasoline range):	NWTPH-Gx
Semivolatile petroleum hydrocarbons (diesel range):	NWTPH-Dx
BTEX (benzene, toluene, ethylbenzene, xylene) and MTBE	SW 8260B

Decontamination

No decontamination is needed if disposable bailers are used. The water level indicator probe (and any other downhole equipment) will be decontaminated between wells by detergent washing and rinsing with deionized water. Pump equipment will be purged with detergent water followed by tap water.

Residuals Management

All extracted groundwater and decontamination water will be containerized onsite for appropriate treatment and/or disposal.

REPORTING

Groundwater compliance monitoring reports will be provided to Ecology on a quarterly basis and documentation will include the following:

- map showing monitoring well locations and status
- summary table and laboratory analytical results
- field sampling sheets
- table of groundwater elevations, updated hydrographs, and groundwater flow map
- data summary related to treatment system performance

FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Instrument Calibration

Instruments used in the field such as: photoionization detector (PID), pH meter, and/or conductivity meter will be calibrated prior to use in accordance with standard practices and manufacturer instructions. Instrument drift will also be evaluated periodically during the period of use dependent upon changing ambient conditions.

Duplicates

Field duplicate samples will be collected for groundwater at a minimum frequency of 10% of the total number of samples submitted for laboratory analyses.

Sample Identification and Chain-of-Custody

All groundwater samples will identified, using the following:

- Site name
- Monitoring Well number
- Date of sample collection

All samples will be logged on a chain-of-custody form provided by the laboratory and remain in the custody of the individual collecting the sample until released (signature on chain-of-custody form) upon shipment or delivery to the laboratory. The laboratory will acknowledge receipt of the samples and provide a copy of the chain-of-custody form for the project files.

LABORATORY QA/QC

Analytical Methods and Target Detection Limits

Parameters	Methods	Detection Limits
Volatile hydrocarbons (gasoline range):	NWTPH-Gx	250 µg/l
Semivolatile hydrocarbons (diesel range):	NWTPH-Dx	250 µg/l
Benzene:	SW 8260B	1.0 µg/l
Toluene:	SW 8260B	1.0 µg/l
Ethylbenzene:	SW 8260B	1.0 µg/l
m,p-Xylene:	SW 8260B	2.0 µg/l
o-Xylene:	SW 8260B	1.0 µg/l
Methyl tert-butyl ether (MTBE):	SW 8260B	5.0 µg/l

Laboratory Quality Control Protocols

METHOD BLANKS

Preparation blanks are analyzed a a minimum of once for every batch of samples, or twenty (20) samples, or matrix type, whichever is more frequent. A preparation blank consists of laboratory pure water that is processed through all procedures, materials, and labware used for sample preparation and analysis. In cases of non-aqueous samples, reagent blanks serve as preparation blanks. Sample batches that contain contaminated blanks are routinely re-prepared.

LABORATORY CONTROL SAMPLE

A laboratory control sample (LCS) is a sample of known value used to validate the analytical procedure. One LCS is used for every batch of samples, or twenty (20) samples, or matrix type, whichever is more frequent. Sample batches containing LCS's that are out of control limits are re-prepared. Control limits for solid LCS's are set by the supplier (typically $\pm$3%). Water or other aqueous LCS's have control limits of $\pm$20%.

For organics analysis, the LCS is prepared from different reference materials than those used in the preparation of the instrument calibration standards. Control limits specified by the method are used to monitor system performance.

DUPLICATE SAMPLE

Aliquots are made in the laboratory of the same sample, and each aliquot is treated exactly the same throughout the analytical method. The relative percent difference (RPD) between the values of the duplicates, as calculated below, is taken as a measure of the **precision** of the analytical method.

$$RPD = \frac{|S - D|}{(S + D) / 2} \times 100$$

Where, RPD = Relative Percent Difference
S = First Sample Value (original)
D= Second Sample Value (duplicate)

One duplicate sample is used for every batch of samples, or twenty (20) samples, or matrix type, whichever is more frequent. The tolerance limit for percent difference typically should not exceed $\pm$ 20 RPD. The duplicate is also a measure of the homogeneity of the sample matrix. It can also measure the effectiveness of any grinding, sieving, and mixing preparation.

MATRIX SPIKE, DUPLICATE, AND SURROGATES

A sample matrix spike is prepared by adding a known amount of a pure compound to the environmental sample befor digestion or extraction, and the compound is the same as that being assayed for in the environmental sample. An analytical spike is prepared by adding a known amount of analyte(s) to a known amount of sample digestate or extract. These spikes simulate the background and interferences found in the actual samples. The

calculated percent recovery of the matrix spike is considered to be a measure of the relative **accuracy** of the total analytical method, i.e., sample preparation and analysis. The calculated percent recovery of the analytical spike is considered to be a measure of the relative accuracy of the sample analysis procedure only. Both the matrix spike and the analytical spike are also a measure of the effect of the sample matrix on the ability of the methodology to detect the specific analyte. When there is no change in volume due to the spike, it is calculated as follows:

$$\%\text{Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

Where: SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

Tolerance limits for acceptable percent recoveries are normally $\pm$ 20-25%.

For organics analysis, the same spiking solution used to prepare the LCS is used to prepare the matrix spike and matrix spike duplicate samples. Matrix spike samples are prepared for every batch of samples (20 sample max.). The results obtained from the analysis of these matrix spike samples must meet the same control limits that apply to the LCS.

Surrogates are similar to spikes, except they are a compound not normally found in nature, nor expected in a particular set of samples. Surrogate compounds are added to every sample during the preparation stage. The results for these surrogate compounds must meet the control limits specified by the method.

INTERFERENCE CHECK SAMPLES

For analytes determined by ICP spectroscopy, an interference check sample is run at the beginning and at the end of an analysis sequence. This sample consists of interfering elements at elevated levels to check, and allow the instrument operator to make corrections for, interelement interferences. In cases where the sample matrix is known, and other interelement interferences occur (i.e. As on Cd), the laboratory will make a custom ICS sample if requested. In cases where no analyte is present in the ICS, instrumental values should be $\pm$ 5x the IDL, otherwise the instrumental value should be $\pm$20% of the true value.

Reporting

Laboratory reports will include previously described QA/QC information, as well as chromatograms for the TPH analyses.